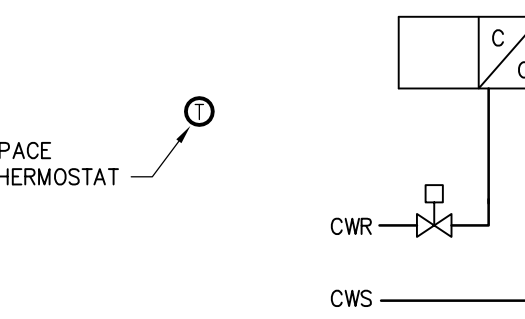


TERMINAL AIR BOX CONTROL SCHEMATIC

SEQUENCE OF OPERATION

A. TERMINAL AIR BOXES

1. WHEN THE AVERAGE OF ROOM TEMPERATURES IS WITHIN SET POINT, THE VAV DAMPER SHALL BE IN ITS MINIMUM POSITION. WHEN THE ROOM TEMPERATURE FALLS BELOW THE ROOM SET POINT, THE TERMINAL HEATING COIL HOT WATER CONTROL VALVE SHALL BE MODULATED TO MAINTAIN THE AVERAGE ROOM TEMPERATURE SETPOINT.
2. WHEN THE AVERAGE ROOM TEMPERATURE RISES ABOVE THE SET POINT, THE TERMINAL HEATING COIL HOT WATER CONTROL VALVE SHALL CLOSE. FOR VARIABLE VOLUME BOXES, THE DAMPER SHALL BE MODULATED OPEN AS THE ROOM TEMPERATURE CONTINUES TO RISE AS REQUIRED TO MAINTAIN THE AVERAGE ROOM TEMPERATURE SET POINT.
3. IN THE UNOCCUPIED MODE, THE TAB'S SHALL BE CONTROLLED TO MAINTAIN THE NIGHT SETBACK SET POINT. A TWO HOUR BUTTON ON THE THERMOSTAT SHALL RESET THE SET POINT TO THE OCCUPIED SET POINT TEMPORARILY. IF ANY VAV BOX IS IN THE OCCUPIED MODE, THE ASSOCIATED AHU SHALL BE INDEXED TO THE OCCUPIED MODE.
4. VAV BOXES ASSOCIATED WITH PROTECTIVE ENVIRONMENT ROOMS (POST AMPLIFICATION ROOM 119A AND ANTE ROOM 119) SHALL BE COORDINATED AND CALIBRATED TO MAINTAIN PRESSURIZATION.
 - a. PROTECTIVE ENVIRONMENT ROOMS SHALL HAVE PRESSURE MONITORS. MONITORS SHALL MAINTAIN POSITIVE 0.01 IN. W.G. THE EXHAUST AIR VALVE/DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE POSITIVE PRESSURE.
5. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENT (A) FOR EACH TAB.
 - a. SPACE TEMPERATURE (I, A)
 - b. DISCHARGE AIR TEMPERATURE (I)
 - c. HEATING HOT WATER VALVE POSITION (I)

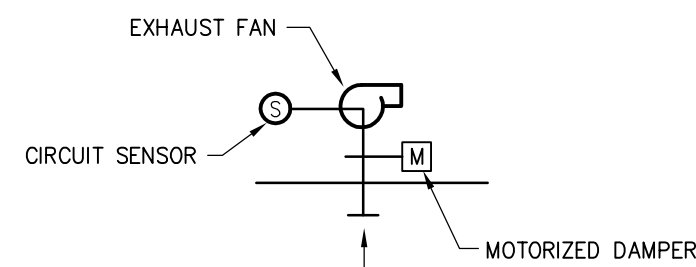


BLOWER COIL UNIT CONTROL SCHEMATIC

NOT TO SCALE

SEQUENCE OF OPERATIONS

1. THE BLOWER COIL UNIT IS A CONSTANT VOLUME SYSTEM THAT INCLUDES A SUPPLY FAN, CHILLED WATER COOLING COIL, HEATING WATER REHEAT COIL AND FILTERS.
2. THE UNIT IS A CONSTANT VOLUME UNIT THAT RUNS 24/7.
3. THE UNIT SHALL BE CONTROLLED BY A REMOTE THERMOSTAT AND DISCHARGE AIR TEMPERATURE SENSOR.
 - a. IF THE THERMOSTAT IS AT SETPOINT (70°F), THE DISCHARGE AIR SHALL MAINTAIN 70°F (O.A.) SETPOINT.
 - b. THE DISCHARGE AIR SETPOINT SHALL BE DISABLED FOR A REMOTE THERMOSTAT CALL FOR HEAT OR COOLING.
4. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENT (A) FOR EACH UNIT.
 - a. SPACE TEMPERATURE (I, A)
 - b. DISCHARGE AIR TEMPERATURE (I)
 - c. CHILLED WATER CONTROL VALVE POSITION (I)
 - d. HEATING HOT WATER CONTROL VALVE POSITION (I)
 - e. FAN START/STOP (I)
 - f. FAN STATUS (A)

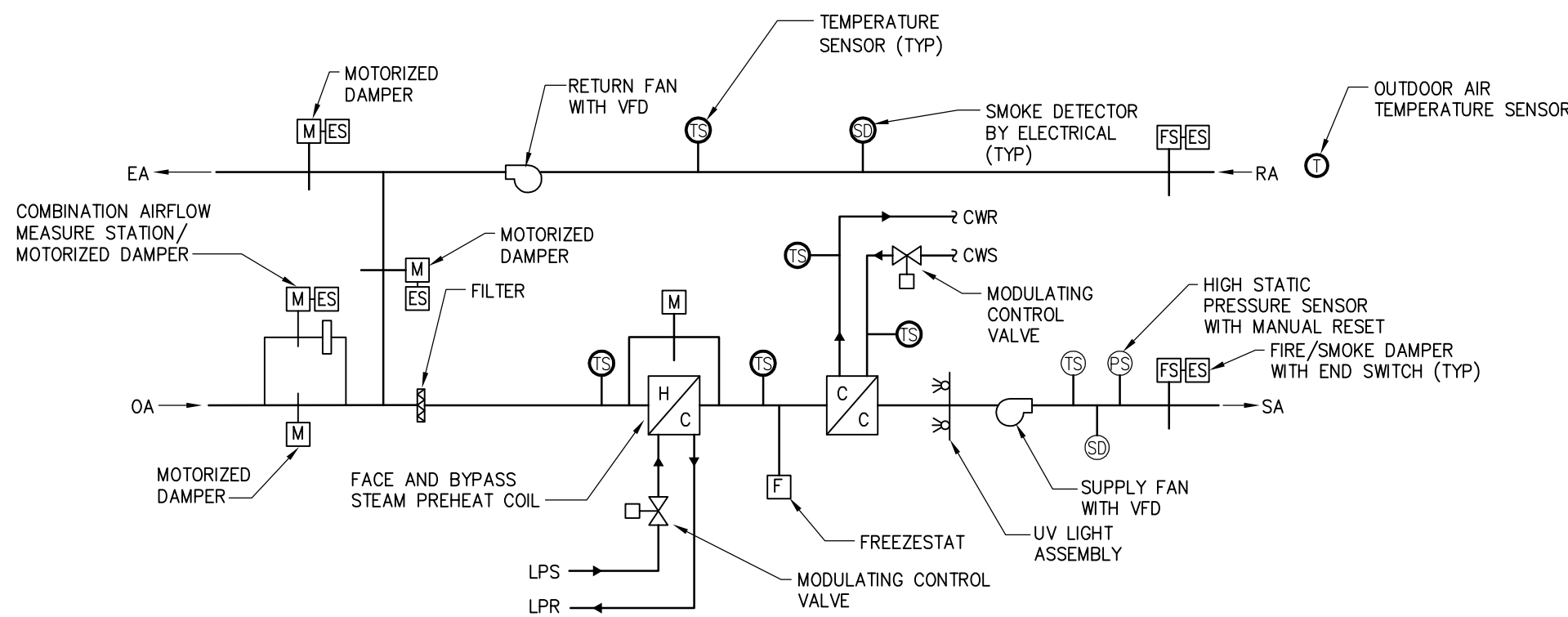


BATHROOM EXHAUST FAN CONTROL SCHEMATIC

NOT TO SCALE

SEQUENCE OF OPERATIONS

- A. EXHAUST FANS: A MOTORIZED DAMPER AT EACH FAN SHALL BE CONTROLLED SO THAT THE DAMPER IS CLOSED WHEN THE FAN IS DE-ENERGIZED. THE FAN SHALL NOT START UNTIL THE RESPECTIVE DAMPER IS PROVEN OPEN. THE FAN SHALL BE ACTIVATED WHENEVER AHU-1 IS IN OCCUPIED MODE.
1. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENTS (A) FOR THE EXHAUST FANS AT THE OPERATOR WORK STATION. (*) INDICATES CRITICAL ALARM POINT. ALARMS FOR FANS SHALL BE SIGNALLED IF THE FAN IS DE-ENERGIZED AND THE CONTROLS CALL FOR THE FAN TO BE ENERGIZED.
 - A. FAN START/STOP (I, A)
 - B. FAN STATUS (A)



VARIABLE VOLUME AIR HANDLING UNIT CONTROL SCHEMATIC (AHU-2-11 AND AHU2-21)

NOT TO SCALE

SEQUENCE OF OPERATION

AIR HANDLING UNIT AHU-2-21

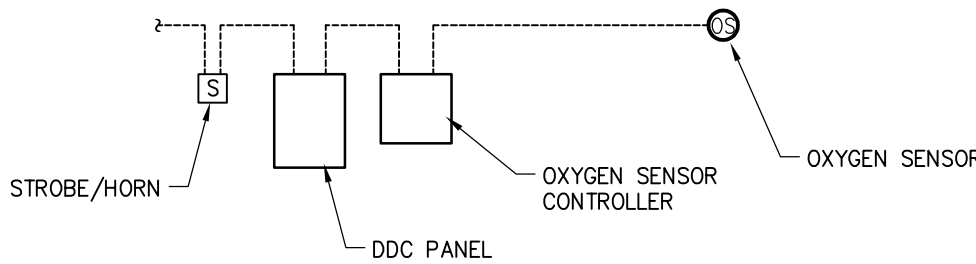
1. THE AIR HANDLING SYSTEM IS A VARIABLE AIR VOLUME SYSTEM THAT INCLUDES A SUPPLY FAN, A RETURN FAN, VARIABLE FREQUENCY DRIVES (BY ELECTRICAL), A STEAM PREHEAT COIL, A CHILLED WATER COOLING COIL, UV LIGHTS, OUTSIDE AIR FLOW MONITORING STATION/DAMPER AND ECONOMIZER DAMPER, RELIEF AIR DAMPER, RETURN AIR DAMPER, LEAVING AIR TEMPERATURE CONTROLLER, RETURN AIR TEMPERATURE SENSOR, MIXED AIR TEMPERATURE SENSOR, FREEZE/STAT, STATIC PRESSURE SENSOR.
2. WHEN THE SYSTEM IS COMMANDED ON BY THE CONTROL PANEL, THE SUPPLY AND RETURN FANS SHALL START AND RUN CONTINUOUSLY. EACH FAN SHALL START IN LOW SPEED TO MINIMIZE OVERLOADING OF THE MOTOR. THE OUTDOOR AIR DAMPER(S) SHALL BE POSITIONED TO DELIVER MINIMUM AIRFLOW.
3. THE AIR HANDLING SYSTEM SHALL BE CAPABLE OF OPERATING IN THREE MODES THAT INCLUDE A MECHANICAL COOLING MODE, AN ECONOMIZER COOLING MODE, AND A HEATING MODE. THE RELIEF AIR DAMPER SHALL DIRECTLY TRACK THE POSITION OF THE OUTDOOR AIR DAMPER. THE RETURN AIR DAMPER SHALL REVERSE TRACK THE OUTDOOR AIR DAMPER. EACH DAMPER SHALL BE ACTUATED SEPARATELY TO ALLOW FOR FIELD ADJUSTMENTS BY THE BALANCER AS REQUIRED TO MAINTAIN PROPER PRESSURIZATION.
 - A. MECHANICAL COOLING MODE: THE SYSTEM SHALL BE PLACED IN THIS MODE WHENEVER THE OUTSIDE AIR TEMPERATURE IS HIGHER THEN RETURN AIR TEMPERATURE. IN THIS MODE, THE OUTDOOR AIR DAMPERS SHALL BE POSITIONED TO DELIVER MINIMUM AIR FLOW. THE COOLING COIL CONTROL VALVE SHALL BE MODULATED AS REQUIRED TO MAINTAIN A SUPPLY AIR DISCHARGE TEMPERATURE OF 55°F (ADJUSTABLE).
 - B. ECONOMIZER MODE: THE SYSTEM SHALL BE PLACED IN THIS MODE WHENEVER THE OUTSIDE AIR TEMPERATURE IS LOWER THAN THE RETURN AIR TEMPERATURE. IN THIS MODE, THE SYSTEM SHALL BE CONTROLLED BY AN ECONOMIZER PROGRAM. IF THE ROOM SUPPLY AIR TEMPERATURE RISES ABOVE THE SET POINT OF 55°F (ADJUSTABLE) AND THE HEATING VALVE IS CLOSED, THE OUTDOOR AIR ECONOMIZER DAMPER SHALL BE SLOWLY MODULATED OPEN AND THE RETURN AIR DAMPER MODULATED CLOSED TO MAINTAIN A SUPPLY AIR DISCHARGE TEMPERATURE OF 55°F (ADJUSTABLE).
 - C. HEATING MODE: IN THIS MODE THE OUTDOOR AIR DAMPERS SHALL BE POSITIONED TO DELIVER MINIMUM AIRFLOW. WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 50°F AND ABOVE 20°F (ADJUSTABLE), THE FACE AND BYPASS DAMPERS SHALL BE POSITIONED TO FULL FACE AND THE STEAM HEATING VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SET POINT OF 55°F (ADJUSTABLE). WHEN THE OUTSIDE AIR TEMP FALLS BELOW 20°F (ADJUSTABLE), THE STEAM HEATING VALVE SHALL FULLY OPEN AND THE FACE AND BYPASS DAMPERS SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR SET POINT OF 55°F (ADJUSTABLE). INDIVIDUAL ZONE TEMPERATURE SENSORS SHALL MODULATE ITS RESPECTIVE TERMINAL AIR BOX TO MAINTAIN SPACE TEMPERATURE SET POINT.
 - D. UNOCCUPIED MODE: THE AIR HANDLING SYSTEM SHALL RUN JUST AS IN THE OCCUPIED MODE EXCEPT THE OUTDOOR AIR DAMPER SHALL BE CLOSED AND THE ROOMS SHALL BE IN NIGHT SETBACK.
4. THE SUPPLY FAN VARIABLE SPEED DRIVE WILL MODULATE THE SUPPLY FAN IN RESPONSE TO A STATIC PRESSURE SENSOR LOCATED IN THE SUPPLY DUCT TO MAINTAIN A PRESET, BUT ADJUSTABLE, STATIC PRESSURE IN THE SUPPLY DUCT SYSTEM. THE PRESSURE SENSOR SHALL BE LOCATED APPROXIMATELY 2/3 OF THE DISTANCE FROM THE FAN TO THE FURTHEST VAV BOX. THE RETURN FAN AIRFLOW SHALL BE MODULATED BY THE VFD AS REQUIRED TO TRACK THE SUPPLY FAN AT THE DIFFERENCE BETWEEN THE SUPPLY FAN, AND EXHAUST AIRFLOW.
5. INTERFACE WITH FREEZE/STAT A CAPILLARY TUBE, MANUALLY RE-SETTABLE. HARD-WIRED FREEZE PROTECTION TEMPERATURE SWITCH IN THE AIR HANDLING UNIT. WHEN TEMPERATURES 40°F OR LESS (ADJUSTABLE) COME IN CONTACT WITH ANY PORTION OF THE CAPILLARY TUBE, THE FOLLOWING SHALL OCCUR:
 - A. THE STEAM CONTROL VALVE (N.O.) SHALL FULLY OPEN.
 - B. THE RETURN AIR DAMPER SHALL OPEN, AND THE RELIEF AND OUTDOOR AIR DAMPERS SHALL CLOSE.
 - C. THE SUPPLY AIR FAN SHALL INDEX OFF (REGARDLESS OF WHETHER THE STARTER IS IN THE HAND OR AUTO POSITION).
 - D. AN ALARM SHALL BE ISSUED THROUGH THE DDC SYSTEM.
 - E. THE SYSTEM SHALL BE LOCKED INTO THE FREEZE PROTECTION MODE UNTIL MANUALLY RESET BY A PUSH BUTTON ON THE COVER OF THE FREEZE PROTECTION TEMPERATURE SWITCH.
6. WHEN THE UNIT IS COMMANDED OFF, OR THE SYSTEM IS SHUT DOWN BY A PRESSURE SWITCH, THE SUPPLY FAN SHALL STOP. THE OUTDOOR AIR DAMPERS SHALL FULLY CLOSE, THE RETURN DAMPER SHALL FULLY OPEN, AND THE RELIEF FAN SHALL BE DEACTIVATED.
7. A SMOKE DETECTOR (BY ELECTRICAL) SHALL BE INSTALLED IN BOTH THE SUPPLY AND RETURN DUCTS. IF SMOKE IS DETECTED BY THE DETECTOR, THE SYSTEM SHALL BE SHUT DOWN AND SHALL ACTIVATE THE FIRE ALARM.
8. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENT (A) FOR EACH AIR HANDLING UNIT: (*) INDICATES CRITICAL ALARM POINT.
 - A. RETURN AIR HUMIDITY (I)
 - B. MIXED AIR TEMPERATURE (I)
 - C. RETURN AIR TEMPERATURE (I)
 - D. DISCHARGE AIR TEMPERATURE (I, *)
 - E. HEATING COIL DISCHARGE TEMPERATURE (I)
 - F. SUPPLY AND RETURN FAN START/STOP (I, A, *)
 - G. SUPPLY AND RETURN FAN ON/OFF STATUS (I, A, *)
 - H. CHILLED WATER SUPPLY, RETURN TEMPERATURE (I)
 - I. MINIMUM OUTSIDE AIR VOLUME SET POINT (AIR FLOW) (I, A)
 - J. LOW LIMIT PROTECTION ALARM STATUS (I, *)
 - K. OCCUPIED/UNOCCUPIED MODE STATUS (I, A)
 - L. VARIABLE SPEED DRIVE HZ (I)
 - M. STEAM CONTROL VALVE POSITION (I)
 - N. CHILLED WATER CONTROL VALVE POSITION (I)

LIQUID NITROGEN STORAGE ROOM EXHAUST FAN CONTROL SCHEMATIC

NOT TO SCALE

SEQUENCE OF OPERATIONS

- A. EXHAUST FAN: A MOTORIZED DAMPER AT EACH FAN SHALL BE CONTROLLED SO THAT THE DAMPER IS CLOSED WHEN THE FAN IS DE-ENERGIZED. THE FAN SHALL NOT START UNTIL THE RESPECTIVE DAMPER IS PROVEN OPEN. THE FAN SHALL BE ACTIVATED AT ALL TIMES.
1. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENTS (A) FOR THE EXHAUST FANS AT THE OPERATOR WORK STATION. (*) INDICATES CRITICAL ALARM POINT. ALARMS FOR FANS SHALL BE SIGNALLED IF THE FAN IS DE-ENERGIZED AND THE CONTROLS CALL FOR THE FAN TO BE ENERGIZED.
 - A. FAN START/STOP (I, A)
 - B. FAN STATUS (A)

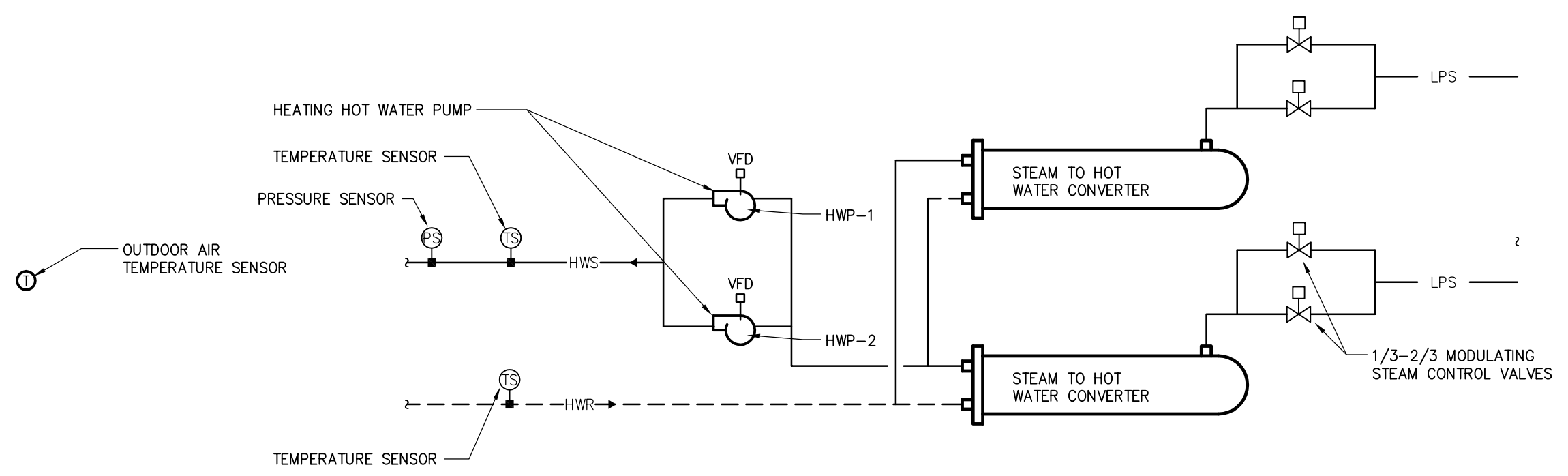


OXYGEN DEPLETION DETECTOR SCHEMATIC

NOT TO SCALE

SEQUENCE OF OPERATIONS

1. UPON ACTIVATION OF THE OXYGEN SENSOR, THE DDC PANEL SHALL RECEIVE A SIGNAL FROM THE OXYGEN SENSOR CONTROLLER VIA BACNET THEN THE STROBE/ALARM(S) SHALL ACTIVATE. SYSTEM SHALL REMAIN IN THIS STATE UNTIL THE CONTROLLER IS MANUALLY RESET.
2. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENTS (A) AT THE OPERATOR WORK STATION. (*) INDICATES CRITICAL ALARM POINT.
 - A. OXYGEN SENSOR STATUS (I, *)



HEATING HOT WATER PLANT CONTROL SCHEMATIC

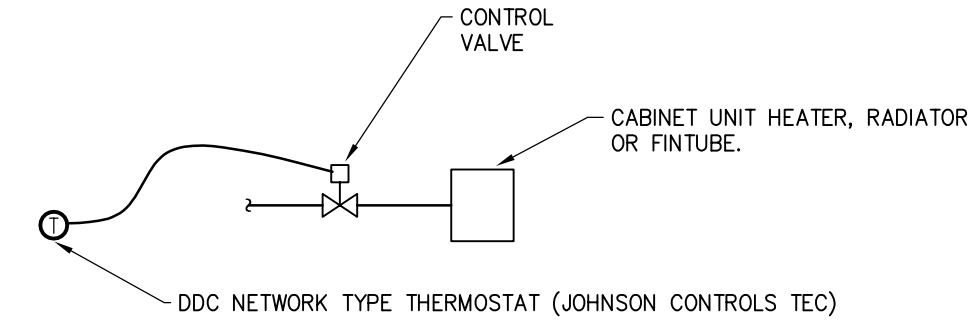
NOT TO SCALE

SEQUENCE OF OPERATIONS

HEATING HOT WATER PLANT

1. THE HEATING SYSTEM CONSISTS OF AN EXISTING STEAM SYSTEM, ONE STEAM TO HOT WATER CONVERTER, AND TWO NEW MAIN DISTRIBUTION PUMPS WITH VARIABLE SPEED DRIVES.
 - a. MAIN DISTRIBUTION PUMPS (HWP-1,2): THE PUMPS SHALL BE CONTROLLED BY A HAND-OFF-AUTO SWITCH. IN THE AUTO MODE, EITHER PUMP SHALL BE DESIGNATED AS THE STANDBY PUMP. PROVIDE A PUMP SEQUENCER PROGRAM TO ALLOW MANUAL AND AUTOMATIC SWITCHOVER BETWEEN THE LEAD AND STANDBY PUMPS TO EQUALIZE RUN TIME. IF THE LEAD PUMP SHOULD FAIL, THE FLOW SWITCH SHALL ALERT THE BMS AND ENERGIZE THE DELAY RELAY. IF THE FLOW IS INTERRUPTED FOR MORE THAN 20 SECONDS (ADJUSTABLE), THE BMS SHALL SIMULTANEOUSLY DE-ENERGIZE THE LEAD PUMP, ENERGIZE THE STANDBY PUMP, AND ACTIVATE AN ALARM. THE VARIABLE SPEED DRIVE SHALL CONTROL THE RESPECTIVE PUMP IN RESPONSE TO A STATIC PRESSURE CONTROLLER LOCATED IN THE SUPPLY PIPING TWO-THIRDS DOWNSTREAM OF THE PUMPS.
 - b. STEAM-TO-HOT WATER CONVERTER: THE 1/3 - 2/3 CONTROL VALVES ON THE CONVERTER STEAM SUPPLY SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE HOT WATER SUPPLY TEMPERATURE SETPOINT. THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL BE RESET IN RESPONSE TO THE OUTDOOR AIR SENSOR AS FOLLOWS:

OUTDOOR AIR TEMPERATURE	HEATING HOT WATER SUPPLY TEMPERATURE
ABOVE 70° F	120° F
50° TO 70° F	140° F
30° TO 50° F	160° F
BELOW 30° F	180° F
 - c. INDICATIONS/ADJUSTMENTS: PROVIDE THE FOLLOWING INDICATIONS (I)AND ADJUSTMENTS (A) FOR THE HEATING PLANT: (*) INDICATES CRITICAL ALARM POINTS.
 - 1) HWP-1, 2 START/STOP (A)
 - 2) HWP-1, 2 LEAD/LAG (A)
 - 3) HWP-1, 2 STATUS (I, *)
 - 4) CONVERTER, CONTROL VALVES, % OPEN (I)
 - 5) HOT WATER SUPPLY TEMPERATURE (I, A)
 - 6) HOT WATER RETURN TEMPERATURE (I)
 - 7) VARIABLE SPEED DRIVE HZ (I)
 - 8) OUTSIDE AIR TEMPERATURE (I)
 - 9) SYSTEM STATIC PRESSURE (I, A)

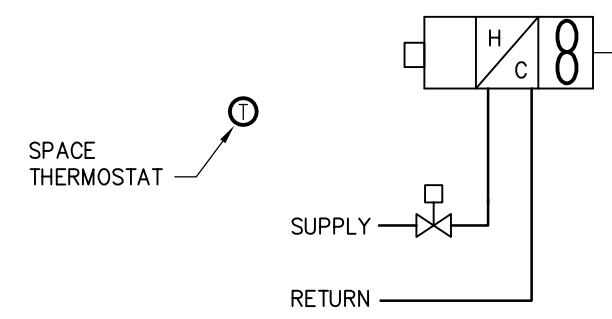


PERIMETER HEAT (IN HEATING ONLY ZONE)

NOT TO SCALE

SEQUENCE OF OPERATION

- A. PERIMETER HEAT
 1. WHEN THE ROOM TEMPERATURE FALLS BELOW THE ROOM SETPOINT, THE 2 - POSITION CONTROL VALVE SHALL OPEN AT THE CABINET UNIT HEATERS.
2. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENTS (A) FOR EACH TAB.
 - A. SPACE TEMPERATURE (I, A)



UNIT HEATER CONTROL SCHEMATIC

NOT TO SCALE

SEQUENCE OF OPERATIONS (APPLIES TO HOT WATER AND STEAM UNIT HEATERS)

- A. UNIT HEATERS
 1. PROVIDE A SPACE THERMOSTAT, START THE UNIT FAN AND OPEN THE 2-POSITION CONTROL VALVE IF THE SPACE TEMPERATURE FALLS BELOW THE SET POINT.
 2. PROVIDE THE FOLLOWING INDICATIONS (I) AND ADJUSTMENT (A) FOR EACH UNIT.
 - a. SPACE TEMPERATURE (I, A)
 - b. CONTROL VALVE POSITION (I) (HOT WATER AND STEAM)
 - c. FAN START/STOP (I)
 - d. FAN STATUS (A)

ALL SET POINTS SHALL BE ADJUSTABLE.
ALL SET POINTS PROVIDED AT THAT BMS HEAD END COMPUTER SHALL INCLUDE DESCRIPTIONS OF EACH SET POINT.

2-1

Project No.
DVA#636-311
S-H#110240-0

DRAWING NO.

2-H10

Dwg. 22 Of 24

Veterans Administration

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Drawing Title

MECHANICAL
CONTROL DIAGRAMS

Approved: Division Chief

Approved: Service Director

Project Title

RENOVATE AND EXPAND
SPACE FOR PATIENT
SUPPORT AREAS

Building Number

2

Checked

TRF

Drawn

MSJ

Location

IOWA CITY VA HEALTH CARE SYSTEM
IOWA CITY, IOWA